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Low-carbon development in remote Indigenous communities: Applying a community-directed model to support endogenous assets and aspirations

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ABSTRACT

Remote Indigenous communities in Australia, which are generally small and widely distributed across the continent, face several socio-economic disadvantages. Yet, there are also many successful examples of Indigenous-led enterprises and initiatives in these locations. A history of top-down government policies pertaining to these communities has led to calls for improved engagement with residents regarding economic development, service delivery and climate change vulnerability. At the same time, increased carbon emissions are likely to ensue from economic development efforts if not planned carefully. This article proposes a community-directed approach, the Resilient Communities and Livelihoods Asset Integration Model (ReCLAIM) to achieve low-carbon development in line with the United Nations Sustainable Development Goals. The design of the model is outlined, along with the results of applying the first step of the model, an asset and aspirations identification workshop, with two remote Indigenous communities in Australia. The results of the first workshop indicate that residents in these communities are already applying efficiency, resource-sharing and other strategies to limit resource use. Therefore, the focus in these communities should be on assisting and enhancing outcomes of these endogenous strategies, rather than the behaviour change approach that has often been applied within low-carbon programmes. Behavioural efficiency measures alone will also provide little impact, without commensurate changes to building design and energy supply systems. Both communities had a diversity of assets to employ towards mitigation strategies and development aspirations, although deficiencies in funding, resourcing and long-term working partnerships were also identified. Selection criteria to screen potential strategies were developed from workshop responses, and the process would be applicable to similar communities, globally.

1. Introduction

Two of the most pressing global challenges today are climate change due to anthropogenic carbon emissions and poverty. Both are included in the UN Sustainable Development Goals (SDG) (UN, 2015). In Australia these two issues are particularly pertinent. The nation is one of the highest per capita carbon emitters in the world (Garnaut, 2008; OECD, 2014). Many of Australia's Indigenous (Aboriginal and Torres Strait Islander) peoples live in poverty in terms of access to opportunities (Altman and May, 2010), and disadvantage compared to non-Indigenous residents (SCRGSP, 2014b, 2016). A key challenge will be to improve socio-economic status while reducing environmental impacts (Wood and Garnett, 2009). However, understanding the mitigation potential for current and future avoided emissions, coupled with the aspirations of Indigenous communities, would appear to be a sound basis for low-carbon development (LCD) that promotes equity in development objectives. For the purpose of this article, LCD relates to the sources of greenhouse gas emissions included in community carbon profiles already published for this research project: embodied (materials and construction), stationary energy, transport systems, water systems, and solid waste disposal (see Stewart et al., 2016). Also, some mitigation actions provide adaptation benefits, such as passive-solar house design which reduces electricity use and also enhances thermal comfort levels (Reardon et al., 2010), and solar photovoltaics can increase energy security for communities with flood-affected roads restricting access to fuel supplies (Green et al., 2009).

After a series of failed government policies which had removed Indigenous Australians from their traditional lands, government support for a return to small discrete communities began in the 1970s (Altman and May, 2010). These were initially independent self-built and governed settlements, however most became dependent on government funding for their infrastructure (Memmott and Moran, 2001). Australian governments (Federal, State and Territory) have since supported the communities to varying degrees, however service delivery

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and administration has been problematic, leading to ongoing dissent regarding funding responsibilities (Altman and May, 2010).

According to 2016 census data, the Australian Indigenous population numbered 649,171, which is approximately 2.8% of the national population (ABS, 2017). The latest national community survey revealed that there were approximately 80,500 people living in 1112 discrete remote Indigenous communities (ABS, 2007). These remote communities are widely distributed, mainly across the northern half of the continent, with defined physical or legal boundaries and community-controlled infrastructure. A map depicting community locations within defined remoteness regions has been published (see ABS, 2007, p. 122). The populations of these communities can vary at different times of the year for various reasons (Biddle and Prout, 2009), but the majority of the communities are small. Approximately 75% reported a population of less than 50 people and over 90% reported less than 200 people (ABS, 2007). Only 1% had a population of over 1000 people.

Settlement structures within discrete communities are not uniform but include some form of housing, and a varying combination of public facilities that may include administration offices, halls, stores, art/cultural centres, schools and other buildings. Essential service infrastructure including energy supply, water supply, and wastewater management is also usually present (ABS, 2007).

A complex set of factors impact on remote Indigenous Australians' ability to participate in economic markets including investment deficiencies in infrastructure and facilities, lack of property rights and preventable health problems (Altman et al., 2008; Taylor, 2008). Contributory determinants of poor health include sedentary lifestyles, lack of dietary fruit and vegetable intake, obesity, overcrowded households, higher unemployment rates, lower income levels, and exposure to violence (AIHW, 2013). Recent Government reports that monitor Indigenous disadvantage reveal that significant disparities with the non-Indigenous population continue, including a life expectancy gap of up to 10.6 years, lower incomes and employment rates, and higher rates of chronic disease and incarceration (SCRGSP 2016). Those living in remote communities also have fewer employment options (ABS, 2012). The high level of government funding (approximately $30.3 billion in 2012–13) is not providing the expected improvements in overcoming Indigenous disadvantage (SCRGSP, 2014a).

Despite these factors, there are several examples of successful Indigenous-led enterprises and initiatives including construction and training services (Memmott, 2010), youth development programmes (MacCallum et al., 2010), tourism ventures (Griffiths and Kinnane, 2011), wildlife enterprises (Austin and Garnett, 2011) and carbon management via traditional fire management techniques (Heckbert et al., 2009). There is also growing evidence that those living active and traditional lifestyles in small remote communities have increased health and social outcomes, compared to more centralised residency, such as in towns (Burgess et al., 2008; McDermott et al., 1998; Rowley et al., 2008). Potential wider social and ecological benefits can also ensue from sustaining these remote communities, such as carbon emission reduction and biodiversity conservation via traditional ecological knowledge practices (Altman and May, 2010). For instance, traditional fire management reduces intense bushfire risks, maintains a range of habitats for wildlife, and yields plant and animal food sources (Yibarbuk et al., 2001).

Recent Australian Indigenous affairs policies have resulted in severe funding cuts, major redesign of programmes and services and large budgetary allocations to income management, which restricts welfare recipients' spending, resulting in increasing uncertainty for Indigenous peoples (Gooda, 2014).There have been calls for improved engagement with Indigenous community residents regarding economic development, service delivery (Cox, 2014; Fien et al., 2011; Memmott, 2010; Moran et al., 2009; Seemann and Marinova, 2010; Seemann et al., 2008; Smith et al., 2008) and climate change response planning (Green et al., 2009, 2012; Langton et al., 2012; Petheram et al., 2010). There are now attempts at the Federal and State Government levels to address community engagement (see DRD, 2016; PM&C, 2017), however they are in the early stages of development, and have not been assessed.

An asset-based approach that recognises and harnesses these assets and skills is needed to generate sustainable development outcomes (Altman, 2011; Fisher, 2002; Moran et al., 2007; Newman, 2006; Seemann et al., 2008). Therefore, this article outlines a proposed model based on socially-oriented, participatory approaches, of asset-based community development (Kretzmann and McKnight, 1996, 1993) and the Sustainable Livelihoods Framework (DFID, 1999; Scoones, 1998). These approaches focus on existing capacities and endogenous-driven strategies, rather than needs or issues. They have proven successful in a range of contexts (Carney, 2002; Emery and Flora, 2006; Hussein, 2002; Mathie and Cunningham, 2005; Scoones, 2009). They have also been used in several Indigenous research projects (see Austin and Garnett, 2011; Bennett et al., 2012; Davies et al., 2008; Fisher, 2002; Greiner et al., 2012; Howitt et al., 1990; LaFlamme, 2011; Moran et al., 2007; Seemann et al., 2008). However, as Garnett and Gorman (2009) note, it is the level of engagement that occurs within a framework that will influence the project's outcomes and degree of benefit.

These socially-oriented approaches would also appear to be potentially effective in tackling climate change mitigation. A recent review of low-carbon programmes in Australia found that adopting a socio-technical approach (incorporating local contexts and practices), was more likely to be successful than a techno-economic model relying purely on technology and economic incentives, such as price (Moloney et al., 2010).

This article focuses on the design and application of a decision-support model that provides a community-directed approach to strategy evaluation, selection and implementation. The model, named the Resilient Community and Livelihood Asset Integration Model (ReCLAIM), has six interrelated steps within its research phase, and this article discusses the application of the first of these steps – the asset and aspirations identification workshop.

2. Methods

2.1. The ReCLAIM model

The ReCLAIM model combines the three techniques of participatory approaches (see Chambers 1994, 2002; Pretty et al.1995), asset-based community development (Kretzmann and McKnight, 1996, 1993) and the Sustainable Livelihoods (SL) Framework (DFID, 1999; Scoones, 1998). A key focus was the SL five asset pentagon: human, social, physical (or built), natural and financial capital. These three techniques were combined and framed within a rational-comprehensive planning model (RCPM). This focuses on goals, then identifies the means or strategies that best meet the desired ends, while aiming to maximise the values of society (Bryson, 1995; Lindblom, 1959).

The model was applied with two Indigenous communities in Australia to assist their selection of carbon management strategies. As the identity of the communities is confidential, they are referred to as Community A and Community B. The model was populated with data provided by these two communities, and their ownership of these data and resultant model outcomes is gratefully acknowledged. Ethics approval to conduct the research, in accordance with established guidelines and standards (NHMRC, ARC, AVCC, 2003, NHMRC et al. 2007), was granted by the Murdoch University Human Research Ethics Committee.

Each community was invited to nominate members for their respective Advisory Committee, to take part in the research workshops. As participatory methods can be time-consuming (Walsh and Mitchell, 2002), the Advisory Committee workshops were held at key discussion and decision points so that they were not unduly burdened with extraneous processes.

Although designed as a research methodology, the model could be extended to include detailed design and costing, implementation of

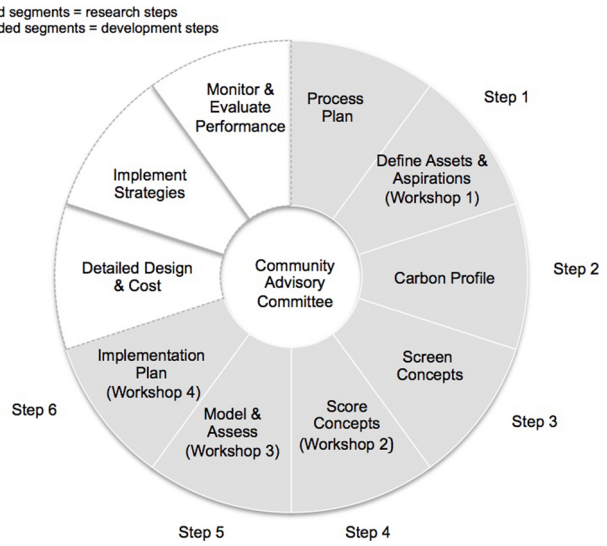

Fig. 1. The ReCLAIM model with six research and three development steps.

strategies, and performance monitoring and evaluation steps for development processes. The model showing planning and research steps 1–6 (shaded segments), followed by three development steps (unshaded segments), in a cycle of continuous improvement are provided in Fig. 1. A description of the research steps is provided in Table 1. This cyclical process has some similarities with the UNEP Sustainability Assessment of Technologies (SAT) model (see UNEP 2012)

2.2. Asset and aspirations workshop

An on-site workshop was conducted with each of the two communities separately. The communities had previously nominated participants to form an Advisory Committee for the series of workshops. These Advisory Committees consisted of community residents, including executive committee members, and represented a range of ages and both genders. All participants consented to being involved in this research.

The five asset classes of the Sustainable Livelihoods framework (DFID, 1999), were introduced and then discussed in-depth to gain the committees' perspectives of important criteria and priorities. The discussion also encompassed their access to resources and available negotiation processes with the external institutional environment. This was followed by a discussion of identified opportunities and threats to the communities and key goals within the next few years. This provided further understanding of vulnerabilities and existing or potential strategies that communities could undertake. Comments received during carbon profiling interviews, conducted during the same research visit, were also incorporated into the analysis.

Analysis was based on the coding mechanism of grounded theory methodology, which promotes inductively generated theory by the process of emergence, as developed by Glaser (1992).Thus, the analysis was conducted in three stages: (i) coding of comments into the predefined asset categories, (ii) further coding into broader emerging concepts that emanated from discussions and finally (iii) development of selection criteria based on the asset and concept relationships to potential carbon opportunities.

2.3. Sampling considerations

The two participating communities were selected on the basis of their previous expressions of interest in low-carbon development opportunities. The sample of two, from a population of approximately 1112 remote communities in Australia, is too small to be considered representative. However, the model outcomes are not meant to be prescriptive, and are intended to identify common themes, contrasts and key insights by communities that were geographically distant. Results were also strengthened when they aligned with those from related fields of study in similar communities, such as adaptation to climate change and improvements to service provision. Therefore, policy implications were identified and alternative approaches for determining mitigation actions could be developed.

The total number of participants at the Asset Workshop (the first workshop of the model) was four at Community A and nine at Community B. On the day, employment commitments of residents at Community A resulted in mainly female attendees. At Community B, a range of ages and both genders attended the workshop. Although small in number, these attendees represented a broad range of community residents, and households, including council members. They could also further discuss the workshop and outcomes with other members when they were available. It was important that the communities decide who should attend the workshop, and the activity was scheduled so their preferences could be met.

3. Results

As the research was not intended to compare the communities' assets and goals, the focus was on common themes with differences noted where relevant. There were obvious cross-linkages between asset categories such as traditional ecological knowledge contributing to both human and natural asset categories. The use of the asset categories provided a focal discussion point for participants to contemplate and respond to, and consideration of linkages between categories and with external processes and institutions.

A table of asset categories, summarising key assets, related comments and suggestions, and overarching aspirations of both

Table 1
Key steps in the ReCLAIM model research phase.

Step	Description
Process plan	Draft process and discuss with participating communities to agree process and timelines. Invite communities to nominate advisory committee members to participate in workshops at key discussion and decision points.
1. Define assets and aspirations (Workshop 1)	Define community assets and aspirations based on the five categories included in the SL asset pentagon. Develop conceptual strategy identification and selection criteria for the screening process in Step 3.
2. Carbon profile	Investigate and calculate the baseline carbon profile of each community to determine where mitigation responses (if any) should be directed. This step also illuminated causes of carbon emissions by source, barriers to low-carbon development in the future, whether any existing mitigation responses were successful and whether there were broader sustainable development concerns to be addressed, such as energy access or poverty issues.
3. Screen concepts	Screen conceptual strategies based on selection criteria developed from Step 1 and the carbon profile calculated in Step 2.
4. Score concepts (Workshop 2)	Discuss the successfully screened conceptual strategies during the second workshop. Scoring conducted by the Advisory Committee to identify preferred and priority strategies.
5. Model and assess (Workshop 3)	Model high scoring strategies with final assessment by the Advisory Committee in the third workshop.
6. Implementation plan (Workshop 4)	Develop an Implementation plan with the Advisory Committee based on existing service provider and stakeholder networks, preferred delivery modes and identify gaps in service provision.

communities, is provided in Appendix A.

3.1. Key concepts

Several key concepts emerged from the discussions about assets. These were generally similar for both communities, although some were more emphatic for either one community. While the key SDGs of poverty (SDG 1) and climate change action (SDG 13) were the focus of this research, other SDGs were also relevant to community concerns. The key concepts with comments and goals expressed by communities, and the relevant SDGs, are included in Table 2. The full list of seventeen SDGs has been published by the United Nations (see UN General Assembly, 2015, p. 14).

3.2. Selection criteria

Selection criteria for future strategies were based on the formulation of key concepts of importance to the communities and the assets they aspired. For the purpose of reporting the research, the criteria for the communities have been combined here, as they were substantially the same for each. When working with a community to establish carbon opportunities the criteria would be individually tailored to that community. The key concepts were distilled into categories of criteria that could be used for selection of carbon management strategies. These criteria display the broad range of factors to be considered within the service delivery parameters, well beyond a simple lowest-cost to supply. Autonomy was a key concept that permeated each of the selection criteria, and therefore was not discussed separately.

The criteria were separated into Phase 1 and Phase 2 criteria. Phase 1 criteria were those to be used for the initial assessment of programs to be discussed in the Scoring Workshop with the communities. Phase 2 criteria (partnerships and support available) were to be discussed later in the Evaluation Workshop after the modelling had been completed and the communities were making their final selection, and to inform the implementation plan. The level of partnership and support available, could be better assessed after the modelling was completed and the strategies selected were more clearly defined. It is acknowledged that the required support may not be available immediately and therefore some options may need to be postponed until it can be obtained. A summary of the selection criteria with examples is provided in Appendix B.

4. Discussion

The workshops with the communities revealed that both had many assets within the five SL asset categories, and some potential opportunities to enhance these existed. The findings suggest that all the asset categories had elements that could be improved to varying degrees, with a particular focus on financial assets, which is a similar result to other findings in Indigenous communities in Australia (Davies et al., 2008; Moran et al., 2007) and Canada (Bennett et al., 2012). While some Indigenous communities are able to offset financial deficiencies with their social capital (West, 2011) this is not always possible for Indigenous communities in Australia. While Community A had many local and regional network opportunities, Community B was not within proximity to as many networking or income generating opportunities and were burdened with high costs of living associated with housing that lacked thermal comfort, and high transport costs. In these cases, internal social capital, and a culture of sharing resources, which was evident in both communities, does not always provide adequate compensation. In this case, dependence on external structures for financial assistance (or improving building, infrastructure and living costs) became critical. These impacts could be reduced with life cycle analysis of socio-economic factors being considered and incorporated within future service delivery (Fien et al., 2011; Seemann et al., 2008) to ensure resident affordability requirements are met.

Key vulnerabilities included the changing government programs and assistance packages, their reliance on external structures for service delivery (in many, but not all cases), and the already noticed and future uncertainty of climate change impacts. The frequently changing external environment was disconcerting to the communities, particularly Community B, as it was more reliant on income support. A stable policy environment that works towards goals and targets that have been developed in conjunction with community residents, incorporating a 'nation building' approach as recommended by Aboriginal and Torres Strait Islander Social Justice Commissioner Mick Gooda (2014, p. 136), is likely to be more effective than the recent regulatory framework. This is likely to require a bipartisan compact between the two major parties, and agreement between Federal and States/Territories to ensure that Indigenous authorities, engagement processes and programmes are not disrupted with changes of government.

The traditional ecological knowledge skills retained by remote Indigenous community residents and the carbon opportunities related to those have been well documented (Barnsley and NAILSMA, 2009; Bowman and Vigilante, 2001; Heckbert et al., 2008; Russell-Smith et al., 2006). This research has highlighted the range of other assets the communities hold across the pentagon of assets, and those they are seeking to acquire. There were many interconnections between these assets. Their decision to live on Country (their traditional lands) enabled them to maintain and pass down traditional ecological knowledge (human asset – knowledge), facilitated hunting activities that in turn supplemented their fresh food supplies (human asset – health), and provided group social activities (social asset) and continuing land management techniques (natural asset). Living on Country was a key strategy that was strongly influenced by cultural practices, and enabled them to enhance other assets and contributed to overall wellbeing. This finding aligns with the suggestions of the SL framework (DFID, 1999), and underpinning concepts of well-being (Chambers, 1995, 1997) that assets can be deployed to achieve more than just income generation, but also to enhance human experience and quality of life (Bebbington, 1999).

These assets in turn can be utilised to develop new assets via the implementation of various strategies, including those relating to carbon management. Both communities appeared to be clear on the assets and resources they could offer and deployment methods to generate asset wealth. However, they both faced restrictions within existing capacities to turn ideas into workable strategies. This highlights the need for external resources to be efficiently supplied, so that funds can be usefully mobilised within the community's agenda, in line with the ABCD philosophy of Kretzmann and McKnight (1996).

Both communities expressed a desire to establish further working relationships and partnerships with external parties, however were not always able to bring these to fruition. Future development policies should encourage and support these partnership identification and implementation processes with industry, government and other external institutions. This is currently being implemented to some degree in Australia, by some organisations, in the private and public sector, voluntarily undertaking Reconciliation Action Plans (RAPs)[1], with measured employment and contracting initiatives within their spheres of operation. However, partnerships could be more strategically identified and positioned within regional and local planning directives, so that Aboriginal community goals are recognised and incorporated within long-term development strategies, with a view to realising mutual benefits. As Marinova et al. (2010) note in relation to their study of Leonora residents, including *Wangkatja* people, this integrated development could emerge via a process of "deliberative dialogue" between

[1] The RAP programme, initiated by NGO Reconciliation Australia, is a framework for organisations to provide employment, market and service delivery opportunities for Indigenous Australians. Further information is available at www.reconciliation.org.au.

Table 2
Key concepts, community comments and relevant SDGs.

Key Concept	Synthesis of community comments and suggestions	SDG
Health and safety	• Recurring focus on preventive and generative health outcomes. • Fruit and vegetable gardens, for affordable, nutritional food • Thermally comfortable homes to reduce air-conditioner use (reported maladies) • Dust control (including roads) to prevent eye injuries • Universal access housing for the elderly • Access to regular health services beneficial, including mental health, as marginalised circumstances caused some distress	2,3,9,11,12
Financial independence	• A key goal of both communities – actively seeking business and employment opportunities • High costs of living a concern – some "living in darkness" as unable to afford electricity • Reducing energy consumption and sourcing local supplies were attractive options • Employment support programmes needed to avoid welfare dependency	1,5,8, 10,11,12
Skill matching for projects	• Broad range of skills available in both communities • Skills often under-utilised due to lack of employment/business opportunities • Training and education ongoing, but more options to utilise skills needed in future • Past training programmes had some disappointing outcomes, as skills not provided at level and duration required • Training and projects should be designed in conjunction with community residents • Long-term project partners needed to ensure adequate knowledge transfer and capacity building	1,4,6,8,10, 16
Resource efficiency	• Efficiency key for labour, energy, water and financial resources • Ease of maintenance and labour-efficient processes needed due to lack of personnel • Water consumption already reduced in some areas to preserve supplies • Energy efficiency of homes already improved with some verandas, screens and roof insulation, but further measures needed • Cost-effective settlement design and resources needed – should be co-designed with residents	1,6,7, 11,12, 13
Facility Function	• Current facilities meet basic functional needs, but improved aesthetics, capacity and comfort required • Better housing, recreational facilities and roads required • Content with retrofitting buildings rather than complete replacement, where energy efficient outcomes possible • Have found gardens useful to assist thermal comfort, and wish to continue or expand these • Renewable energy systems preferred	3,7,9, 11
Living on Country	• Allows communities to care for country in accordance with spiritual and cultural beliefs • Traditional ecological knowledge passed down through the generations • Time spent caring for land to deter introduced species and fire management • Can take advantage of ecological services, with up to 80% of dietary meat from hunting, and recreational and social benefits • Valuable plants can be protected for bush tucker and commercial purposes	1,2,3,4,8, 13,15
Partnerships and support	• Strong internal governance in both communities, but differing levels of external support and industry opportunities • Level of support needs improvement • Long-term strategic partnerships need to be obtained for economic development	1,8,16
Autonomy	• Overarching goal of both communities is autonomy in decision-making • Changing government policies and funding had resulted in few financial assets for communities	1,5,16

the many segregated social groups within a region, to develop a shared vision and exchange knowledge.

Strategies to economise, share resources and increase efficiency were already being implemented in both communities, and traditional practices, such as cooking and heating with fires lowered electricity use. This has also been noted in recent parallel studies, along with recommendations to facilitate ancestral ways (Buergelt et al., 2017). Some measures that would lower energy use, such as improving thermal comfort in housing, either with assistance from programs such as the Centre for Appropriate Technology's former Bushlight Project (see CAT, 2010a, b), or with their housing authority had been undertaken, but more could be implemented. Both communities were keen to expand on the strategies they had begun and consider new ones to mitigate climate change. Therefore, it is expected that energy efficiency programs related to behaviour, while helpful for energy education, will have minimal impact on emission profiles alone. This is due to current energy use (particularly in Community B) being a function of infrastructure deficiencies, which in turn drives carbon emissions. Refocusing on energy-efficient building and infrastructure design (including service provider installations, such as schools and medical clinics) and renewable energy sources, and requisite education to optimise their operational performance, is likely to provide a more significant outcome. As residents of these communities were already pursuing efficiency strategies, the widely used "behaviour change" approach to energy use, applied with varying degrees of success in urban and rural areas across Australia (Moloney et al., 2010), would be misplaced. Instead, the approach should be redirected to behaviour and strategy support, so that endogenous initiatives can be supplemented with technical advice and resources, where requested, to optimise outcomes. While some education for LCD aspects, such as water and energy efficiency (see Kibria et al., 2018), should be included, they should be delivered as part of a strategic asset management plan directed by the community, rather than a series of externally-delivered short training programmes.

Both communities had large multi-asset investments in their traditional lands and did not want to be relocated. They had become increasingly interested in opportunities to grow their financial base and were keen to take advantage of potential land management opportunities to generate carbon credits. Therefore this area of research should be explored further, particularly as little carbon mitigation data exists for remote areas of Australia (Eady et al., 2009; Harper et al., 2007). These research activities would provide a further employment opportunity for remote Indigenous residents. Indigenous peoples in the past have expressed a preference for control over research and development activities in their region, therefore building research governance and leadership skills will enable further livelihood outcomes (Greiner et al., 2012).

Overall, the ReCLAIM model is offered as a potential framework for engaging with remote communities in a collaborative approach that progressively promotes a directorial role of the community council and residents. The model, though applied here successfully in relation to the first step, is not meant to be prescriptive and may need to be adapted to suit community circumstances, preferences, capacity for engagement and desired focal areas. For instance, it may be modified to focus on only one asset category, goal or emission source, though its application should still consider cross-sectoral impacts. The model could also be scaled up to encompass regional plans and develop low-carbon strategies that promote efficiencies and asset creation across broader spatial and institutional structures. While the model was applied to carbon mitigation strategies in this research it could easily be adapted to other

programmes and strategies that remote communities wish to adopt. The assets and aspirations workshop identified a number of relevant Sustainable Development Goals which could be concurrently pursued, or examined in more detail.

5. Conclusions

Community-directed approaches are needed to facilitate economic and low-carbon development in remote Indigenous communities. The six-step ReCLAIM decision-support model, was applied with two remote communities to reveal the diversity and strength of available, though often under-utilised assets. Key deficiencies in funding, resourcing and long-term working partnerships were also identified. The communities had ascertained key aspirations of financial independence and autonomy, and were already implementing resource sharing, efficiency measures and networking strategies to achieve their goals, often related to traditional practices. These assets had already been deployed in several ways in each community, and strategies were in various stages of development to enhance economic development. These foundation strategies, and the selection criteria identified, were used to identify further means for meeting the communities' aspirations while developing a low-carbon economy. The assets and aspirations workshop provides the foundation for a strategy support approach, for the next steps in the model, so that endogenous initiatives can be augmented and appropriate selection criteria identified to screen potential future strategies for individual communities. The model can be applied to address poverty, climate change, and several other Sustainable Development Goals.

Declarations of interest

None.

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Appendix A. Key assets identified

See Table A1.

Table A1
Key assets, aspirations and related suggestions by participants.

Assets of importance	Related comments and suggestions
Physical assets	Aspirations: Resource efficient, easily maintained buildings and infrastructure, with affordable and universal access options preferred
Housing	Low maintenance and open designs preferred with good ventilation; thermal comfort and energy efficiency improvement required; universal access modifications (e.g. bathrooms); some residents cannot afford electricity bills; air-conditioners were suspected cause of health problems in the past; some housing needed replacement and new housing more suited to elderly residents needed; some energy and material efficiency strategies already developed
Community buildings (office, school, store, workshop, medical clinic)	All important to community viability; thermal comfort and energy efficiency improvement required; construction materials provide little thermal modulation
Energy supply system	Renewable energy preferred to diesel generators; solar PV used successfully with energy monitoring units in Community A; gas sometimes preferred for cooking appliances; fuel saving initiatives were actively sought; fire also used for cooking, heating and ceremonial purposes
Roads and airstrips	Preferred sealed roads to reduce dust; dust had been associated with eye afflictions
Vehicles	Usually 4WD and used often due to limited public transport options; fuel expensive; investment in specialised vehicles for community operations and business enterprises
Communication systems	Internet, phone and media connections used extensively; useful for education and training delivery; reduced need for travel
Greenhouse structures	Fruit and vegetable gardens for community supplies and potentially commercial operations sought
Recreational areas and children's playground	Would like improvement and expansion; removal of weeds
Water systems	Bore water systems for supply; current wastewater solutions are adequate but there is risk of groundwater contamination when septic tanks used
Waste systems (landfill)	Landfill systems are simple but time consuming methods; alternative methods sought
Natural	Aspirations: Living on and caring for Country, and utilising natural resources to benefit community and society
Land	Land tenure and native title claims still being sought; connection to Country a core strength for the community; essential for continuing cultural practices and passing on traditional ecological knowledge; bushfires could be a threat and mitigation techniques were utilised
Native fauna and flora	Hunting and bush foods important for recreational, nutritional and medicinal purposes; feral animals and weeds a pest and need to be eradicated; potential for carbon credits if relevant project methodologies approved; firewood collected for cooking, heating and ceremonial purposes
Gardens in settlement areas	Provide shade, cooling and visual amenity around houses and buildings; communities like having gardens and would like further landscaping in some areas; conscious of water demands and careful with water use; food gardens established to some extent and both communities planned to develop and extend them
Groundwater	Reliant on groundwater for water supplies; care needed to prevent contamination
Climate	Changes in rainfall, heat, humidity and storm activity noticed; patterns are changing and unpredictable
Human	Aspirations: Multi-skilled residents, particularly traditional ecological knowledge, with fully employed workforce

(*continued on next page*)

Table A1 (*continued*)

Assets of importance	Related comments and suggestions
Governance skills	Self-governance important for autonomy in management and operations of communities; administration and management skills already employed; some multi-tasking required and more community staff roles would ease workload
Construction & maintenance	Infrastructure and buildings maintained; community projects developed (e.g. garden facilities); also applied to business contract opportunities; plant operation and maintenance; fencing and welding; need external expertise for specialist areas (e.g. electricians for energy system maintenance)
Traditional ecological knowledge	Living on Country essential to maintaining knowledge and passing on to generations; employment prospects in ranger services and mining rehabilitation services; hunting and fishing skills supplement food supplies
Business development skills	Business ideas already generated and being pursued; recognised need for technical advice and support to establish further (e.g. product development, feasibility studies)
Gardening skills	Gardens around houses; fruit and vegetable gardens started; would like to expand for community use and potentially for commercial operations
Social	Aspirations: Autonomous community council with productive external networks
Executive council	Community management and operations are self-governed; working well
Community social structure	Cohesive social structure; formal and informal community associations, meeting places, gatherings and hosting external parties; strong social bonding capital
External community networks	External networks with other communities; can be informal or formal, such as PBC associations and service delivery agreements;
Networks with government agencies, departments, service providers	Networks with many departments and agencies; some working well but others needing improvement; communication needs improvement as requests not always given adequate consideration; long distance travel often required
Industry partnerships	Some partnerships / business relations developed; network opportunities are not always available in some remote regions; new network/partnership opportunities welcomed
Financial	Aspirations: Financial independence for community and residents
Government funding	Changing funding policies led to uncertainty regarding communities' future; welfare payments not always covering costs of living; financial independence preferred and actively sought
Employment	Employment prospects investigated and taken up; not always many employment opportunities available in remote regions; long distance travel frequently required but often to locations other than towns e.g. pastoral station, mining camp, land management area, research site, heritage site
Business Income	Some business initiatives developed; further business proposals being investigated; seeking technical and financial support to develop further
Financial skills	Some residents would benefit from budgeting and financial skills to assist with coping with costs of living and avoiding frauds and scams

Appendix B. Concepts and selection criteria

See Table B1.

Table B1
Concepts and criteria, with examples, by asset category.

Asset	Concepts	Criteria	Examples
Human	Health and safety	Improve health outcomes	Dust control, windbreaks, reduce groundwater contamination risk, increase social cohesion
		Universal access and safety	Design for elderly and children
	Skill matching	Utilise existing skills	Traditional ecological knowledge, construction and maintenance, gardening, project management
		Acquire new skills	Suitable skills training as identified by community (e.g. technology)
Physical	Resource efficiency	Ease of operation and maintenance	Monitored and maintained by community
		Energy efficient	Low energy buildings, Infrastructure and appliances, efficient transport
		Water efficient	Low water demand, water re-cycled where possible
		Time efficient	Efficient processes for community staff (e.g. waste disposal)
	Facility function	Optimal function and service	Landscaping, building size and design, facades, fixtures & fittings, thermal comfort, playgrounds
Natural	Caring for Country	Maintains caring for Country ethos	Land, flora and fauna protection and restoration, reduction of weeds and pests, protection of groundwater, cultural practices
	Ecological services	Food sources	Hunting and fishing, bush tucker plants
		Settlement services	Firewood, shade, windbreaks, commercial harvests, recreation
Financial	Financial independence	Income generation (business development or employment)	Commercial food gardens, tourism, industrial services, carbon farming, mining rehabilitation, ranger services
	Cost effectiveness	Low life-cycle cost	Cost to provide and maintain infrastructure, buildings and services
		Affordability for residents	Affordable energy, water and services
	Financial skills	Finance and budget training	Skills training to protect financial assets
Social	Partnerships & support (Phase 2)	Partnerships exist or can be brokered	Other communities, land councils, industry, government agencies, research bodies
		Support	Support available for duration needed, as identified by community

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